ON THE ADVANTAGES OF THE PRINCIPLE OF DRY DRESSINGS IN ANTISEPTIC SURGERY.

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THE discussion on the Treatment of Wounds at the recent International Medical Congress at Copenhagen differed in a remarkable manner from a similar discussion at the London Medical Congress in 1881. At the London Congress the great point at issue was whether the Listerian principle, that is the principle on which all antiseptic surgery was based, however varied in detail, had been fully established; and the opponents of the principle itself were many and strong. At the late Congress, however, all this was changed; the central point, round which the discussion turned, was the best method of putting the principle in practice. The principle itself found but weak, if any, opposition. Now, that discussion showed one thing conclusively, namely, that however much the principle was valued, however great had been the improvements imported into surgery by the rigorous adoption of Lister's method, still we had not reached finality, that still much remained to be done, and that there still were ends to be gained in our methods of dealing with operation wounds, which Lister's method did not reach.

"The ideal wound," says Mr. Watson Cheyne, "is a subcutaneous one, kept at perfect rest." That definition we may unhesitatingly adopt. By the rigid application of Lister's principle we are able to keep, not the air, but the harmful matters contained in the air and adhering to the surroundings, out of our wounds, and therefore we practically put them on the same footing as a subcutaneous wound. But even a subcutaneous wound will not heal kindly unless it be kept at perfect rest, and in operation wounds we must keep the same principle before us as of the greatest importance. Now, to quote Mr. Watson Cheyne again, and I do so because he is the great exponent of the Listerian method, he tells us that the causes of unrest may be mechanical or chemical. The chemical causes are chiefly two; first and most important, the unrest due to the presence of organisms in the wound, a cause which aseptic surgery has abolished; secondly, the irritation caused by the antiseptic itself. It is not perhaps possible at present to remove this cause of unrest entirely, but it may be reduced to a minimum, at least to such a point that the irritation is not sufficient to interfere with the healthy course of the wound. This Sir Joseph Lister attains by the employment of a protective in the form of specially prepared oil silk which keeps the constant action of the carbolic acid out of the wound. Among the mechanical causes of unrest are especially to be noted movements of the part, the presence of foreign bodies in the wound, tension, whether from tight stitches, or retained secretions, etc. Now, it is in respect to some of these causes of unrest that Lister's method is open to improvement. Mr. Watson Cheyne allows so much when, in speaking of the ideal wound, he says: "We have not yet attained this ideal, for even with the aseptic method there is a certain amount of unrest caused by the antiseptic employed, by the stitches, by *the apparatus for drainage*, and *by the dressing itself*." Now, in this sentence we have lines laid down upon which we must travel if we wish to attain to the ideal.

No one will nowadays deny the importance, when possible, of infrequent dressing. The longer we can leave a wound undisturbed, without interfering with its aseptic condition, so much the better. The dressing of an operation wound causes disturbance both constitutionally and locally. We have frequently seen with what anxiety a patient, and especially a young patient, looks forward to the time of dressing, and in the most skilful and tender hands it is not often possible to remove a dressing, to cleanse the part, to take out or shorten the drainage tube and to put on a fresh supply of gauze, without causing to some extent pain; or even if pain be not inflicted the nervous dread of it is enough, in some patients, to make us wish that we could do without the change altogether. But even when we can neglect the constitutional disturbance excited, can we be always sure that the local movements of the part may not do great injury? Take for example such a case as an excision of the knee, even with the best devised splint, it is a matter of the greatest difficulty to prevent some degree of motion between the fragments when we are obliged to change the dressing, and often the result is materially influenced by it. Yet, again, frequent changing of the dressing exposes the wound to the danger of infection each time the wound is exposed, and though we may have good grounds for believing that the precautions we adopt to insure asepticity are efficient, still, if we can avoid running the risk, we should do so, provided that we do not lose sight of the great principle involved. What I maintain is that as long as we are obliged, by the nature of the dressings we use, to change those dressings frequently, so long we shall fail to obtain that rest for our wounds which is the groundwork of all systems of treatment.

Now with carbolic gauze dressings, we cannot have absolute rest during the healing process. In large wounds, or wounds from which there is much discharge, the dressings must frequently be removed within twelve hours, and in almost all wounds this must be done the day after the operation. Now, as the greatest amount of discharge comes away during the first twenty-four hours, if a fresh dressing is applied at the end of this time, we may be able to leave it on for several days, but it is never safe beyond a week. In many cases a change of dressings is required every second or third day; and the great guide for this is the appearance of moisture at the edges of the gauze. The reasons which oblige us to follow this course are mainly due to two causes, the volatile nature of the antiseptic and the small power of absorption of the material forming the dressing. We all know the ease and rapidity with which carbolic acid volatilizes, and hence the great difficulty we experience in keeping our carbolic dressings in a fit state for use. Oil of eucalyptus has the same fault, and even in the hands of Sir Joseph Lister himself, disastrous results have followed from the deterioration of the dressings due to this cause. But in corrosive sublimate we have an antiseptic of far greater potency than either carbolic acid or eucalyptol, and one which has the great advantage of not being volatile at ordinary temperatures. Since the investigations of Koch, its power is established. A solution of 1 in 300,000 is sufficient to inhibit the development of organisms while 1 in 20,000 will destroy even the spores of the bacillus anthracis, the most resistant of all germs. Here then we have an antiseptic which will retain its power indefinitely in our dressings. When we use it, we need not fear that the antiseptic power of the material will deteriorate in a few days or even weeks.

Secondly, we find that one of the faults inherent in carbolic gauze is its small power of absorption. I have made several experiments to test the relative absorbing power of several materials which have been used for surgical dressings. Ordinary unprepared gauze, as we buy it in the shops, contains a certain amount of fatty substances which interfere with its absorbing power. Such gauze will absorb about three times its own weight of fluid; but if we first wash it in hot water with carbonate of soda we remove its fatty constituents and its absorbing power becomes thereby increased. It will then hold five times or five and a half times its own weight of fluid. A pound of such gauze, for instance, will, when fully saturated, weigh from six to six and a half pounds. But an equally important consideration is that it will absorb this rapidly, say in a few minutes. If a piece of this gauze be thrown on the surface of some water, it will in a few seconds sink to the bottom of the vessel. But it is quite otherwise with Lister's carbolized gauze. Being prepared with resin and paraffine, its absorbent power is very sensibly diminished. If thrown on the surface of water it will continue to float for hours and days. If completely submerged in water for twenty-four hours, it will absorb one and one-fourth times its own weight of fluid, while in three days the quantity of fluid it will take up will be only two and three-fourths times its own weight. This I have proved to be the case, not only with the carbolic gauze manufactured at the Adelaide Hospital, but also with that which we buy in the shops. Thus we see that carbolic gauze holds a very low place in the scale of absorbing materials. In some places on the continent, notably in the hospital at Freiburg in Baden, gauze is use prepared with corrosive sublimate. It is first freed from fat in the way I have described, and it is then charged with corrosive sublimate, previously dissolved in water, to which a small proportion of glycerine has been added. When ready for use the gauze contains about 1 in 500 of corrosive sublimate, and will absorb about five times its weight of fluid. This makes a very nice dressing, but has the disadvantage of sometimes causing much irritation of the skin.

But we have other materials suitable for wound dressings which are far more absorbent even than the gauze freed from its fatty particles. The three most powerful in this respect are absorbent cotton, which will hold fifteen times its own weight; turf-moss, which will hold from eight to nine times, and wood-wool, which will absorb about eight and one-fourth times its own weight of fluid. Thus, absorbent cotton stands first on the list. But it has one great disadvantage, it does not possess that eagerness in absorption, as the Germans call it, which is possessed by turf-moss or wood-wool. What I mean by this is that if absorbent cotton be placed directly over a wound, if the quantity of discharge be very great, it will thoroughly saturate that part of the cotton which lies immediately over the point of exit in the wound, and will show itself externally long before the circumferential part of the dressing has even become damp. It is otherwise with the other two materials. Both wood-wool and turf-moss will gradually diffuse the discharge through the dressing until the greater portion of it has become nearly saturated before the external part of the dressing will show evidence of the discharge coming through. I have been in the habit of charging the turf-moss with corrosive sublimate in the strength of 1 in 400; the wood-wool is prepared with the same antiseptic in the strength of $^1/_2$ per 100. Both of these materials require to be put up into gauze bags previous to use, owing to the difficulty otherwise of applying them over a wound. Lately I have been using a combination of wood-wool and absorbing cotton, devised by von Bruns, of Tübingen, and I have little hesitation in saying that it is the most convenient and suitable dressing I have hitherto found. It is composed of eight parts of wood-wool and two parts of absorbent cotton, so intimately mixed that it can be cut or torn into the size required and applied directly over the deep dressing without having recourse to gauze bags. Out of numerous trials I made of it I found on two or three occasions that it failed to keep the wound aseptic, and this failure I could attribute to no cause other than that which I now have reason to believe the true one, that the wood-wool wadding was not always reliable. It is prepared like wood-wool itself, with corrosive sublimate, but I have ascertained lately they contain the antiseptic in very different proportions. Wood-wool, as I have stated, contains 1 in 200 of corrosive sublimate, while wood-wool wadding contains only 1 in 3,000, This, I believe, is altogether too weak. I represented this to one of the firm of manufacturers, Messrs. Essinger & Co., and he has undertaken to prepare it for use of the strength of 1 in 1,000, which, I think, would be sufficient for our purposes. This material will absorb from nine to ten times its own weight of fluid, so that in this respect it stands even higher than wood-wool or turf-moss.

Now let me say a few words as to the advantage of using a highly absorbent material as a dressing for wounds. It dries the wound by sucking up from it the discharges as fast as they form, provided that there be a free vent for the discharges to reach the surface. This is well illustrated by the drying effect of blotting paper when applied to the wet surface of a freshly written page. This suction power, if I may so express it, is also used by microscopists to remove an excess of fluid from beneath the cover-glass. In a similar manner an absorbent material sucks up the fluid from a wound, and the more absorbent the material is the more rapidly it takes up the discharge. The importance of this is of the first order. "Moistening and putrefaction, drying and preservation, go together," says Mr. Gamgee, in a recent address[1] (and in this statement we must agree with him). "It is along damp courses and alluvial plains that contagia spread, not on sandy hills; so with wounds—the dry ones heal, the wet ones rot."

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[1] Lancet, Oct. 17, 1885, p. 706.

But a highly absorbent material has another advantage. The more fluid it will absorb the longer it will take before it is saturated, and, therefore, the longer it can remain applied to the wound. That is self-evident. But the length of time such a dressing can remain undisturbed depends on other considerations also. In a typical Lister's dressing we know that not only is the wound covered with an impermeable protective, but that the carbolic gauze also is covered by an impervious mackintosh, which effectually excludes the air, and thus prevents the absorbed fluid in the gauze from evaporating. No doubt with carbolic gauze dressings this is absolutely necessary, as otherwise the volatile antiseptic would evaporate and the dressings become inert. But with an antiseptic so stable as corrosive sublimate this is quite unnecessary. We can allow free access of the air to the dressings, and that without fear that the antiseptic properties of the dressings will be materially affected. The dressings give up some of the fluid to the air, and are thus enabled to suck up more from the wound. It would thus appear that if we apply in the first instance sufficient material to prevent the discharge percolating through it within the first twenty-four to forty-eight hours, during which period the discharge is always most abundant, there would be no apparent limit to the length of time a dressing might remain undisturbed. The dressing would thus be a permanent dressing, and one of the most serious causes of unrest in the wound would be abolished. With such a dressing applied in a case where no precaution has been neglected to obtain absolute asepticity in the wound, there is no reason why the dressing should be disturbed at all during the healing process, except it be to remove a drainage-tube or other foreign body from the wound, such as unabsorbable ligatures or sutures. Now, in order to make this method of dry or permanent dressing perfect, we must either use exclusively absorbable ligatures, sutures and drainage tubes, or we must abolish them altogether. At present we cannot do without ligatures and sutures, but we can use exclusively those made of an absorbent material, and at present we possess nothing more suitable in ordinary cases than properly prepared catgut. And here let me say a word about the catgut. We use almost exclusively at the Adelaide Hospital Sir Joseph Lister's chromised carbolic catgut, prepared by ourselves, accordding to the directions he himself laid down, and I cannot recall a case in which it proved untrustworthy, either by its remaining unabsorbed in the wound or by its absorbing too rapidly. It is only unreliable when it is improperly prepared. The same may be said of the catgut prepared with corrosive sublimate according to Neuber's method. This has the advantage of being very easily prepared. The raw catgut, which of course must be of good quality, is first washed with soap. It is then placed in sublimate solution (1 in 1,000) for twenty-four hours, after which it is transferred to a 1 in 1,000 solution of corrosive sublimate in alcohol. In this it is kept till required for use, or it may be preserved in oil of juniper. I have several times tried the catgut prepared with sulphurous acid, sometimes called the green catgut, but I have nearly always found that it remains in the wound unabsorbed for an indefinite length of time, and is very liable to keep a sinus open until it is discharged. So much for the ligatures and sutures. By using those made of proper materials we need have no fear as to their behavior under a permanent dressing. It is otherwise, however, with the drainage tube. Attempts have been made, both by Neuber, of Kiel, and Macewen, of Glasgow, to substitute absorbable drainage tubes for the rubber tubes usually employed. Without entering into particulars it will, for my present purpose, be sufficient to say that they have not been sufficiently successful to warrant their universal adoption. In many cases they have not been absorbed at all. Hence it was that Neuber devised a system of what may be called "natural drainage," by means of which the drainage-tube may be almost entirely abolished. I say almost, for drainage tubes are still of the greatest service in those cases where a large cavity has to be drained, as in empyema, psoas abscess, and the like. But in all ordinary operative wounds, such as removal of tumors, amputations, excisions of joints, even such joints as the knee and the hip, drainage-tubes can be dispensed with, not only with safety, but with material advantage. As the details of this method are not generally understood, let me shortly call your attention to the chief points to be observed. In the first place, there should be absolute hæmostasis. Not only must the larger vessels be secured, but the capillary oozing should be checked. The best plan for this is, I believe, to fill the wound with sponges soaked in hot water containing about 1 in 2,000 of corrosive sublimate, and then drawing the skin together over the sponges to press with the hand till the solution is squeezed out of them. This has the double advantage of stopping oozing and of thoroughly antisepticising the wound. The next point of importance is to insure that there shall be no cavities left in the wound after the skin flaps have been brought together. If a tumor have been removed the space it occupied is abolished by carefully sewing together with catgut the opposing sides of the cavity in which the tumor lay. This is done by beginning at the bottom of the wound and inserting the sutures in successive tiers, until nothing is left but the skin, which is sewed together last. In an amputation, say of the thigh, the periosteum is divided from half an inch to an inch anteriorly to the place where the bone is to be sectioned. This periosteal flap serves as a cover to the divided end of the bone, and its edges are, in the first instance, carefully sutured together. Then the divided muscles are stitched together over this, as much as is possible. Fascia is joined to fascia, and finally skin to skin. In joining the tissues together in this way the deepest stitches are fastened most tightly. We make them a little looser as we progress towards the surface, and finally the skin sutures are the loosest. By this means the discharges are compelled to take a skinward course; in some cases canal-like spaces are left extending from the depth of the wound to a gap left between the skin flaps, or to an artificial hole punched in the skin, through which the discharge can escape. And let it be borne in mind that by this method of deep sutures the discharge from the wound is reduced to a minimum. Where spaces or cavities are left in a wound, there secretion is encouraged to form, and there it will not cease to collect, until by a process of granulation, or by the organization of a blood clot, the cavity ceases to exist; but when the divided parts are all carefully approximated, so that no such cavities shall exist, then the parts become rapidly agglutinated and immediate union ensues. With this object in view we should always endeavor to suture periosteum to periosteum, muscle to muscle, fascia to fascia and skin to skin.

In carrying out these details it will appear that in order to carry off any discharge which may form, and to prevent the possibility of any bagging taking place, we must arrange for the exit of the discharge in that situation which each case will show to be most suitable. In some cases this is easy enough, but in others special circumstances must guide us. As I do not intend in this paper to enter into the statistical side of the question, let me give you here a few illustrative instances. In applying the method of dry dressings and buried or deep sutures to the radical cure of hernia, as soon as the wire sutures closing the rings have been secured, and all hæmorrhage has been arrested, I have in all my later cases sewn together first the divided layers of fascia. The edges of the skin are then brought together with a continuous suture, but the stitches have been put in obliquely, so as to draw more on one side than on the other, and in this way to leave a pucker at the upper angle of the wound, that is the end furthest removed from the pubis, and I have invariably found this pucker to be ample for the purposes of drainage. The dressings are applied as follows: A piece of sero-sublimate gauze is wrung out in carbolic solution and applied wet over the wound and over the contiguous skin. Then over this is placed either one or two pads of wood-wool or prepared turf-moss, and the whole is firmly bandaged on with an ordinary calico roller. With the exception of one case in which I used wood-wool wadding, which I believe now to be inefficient from an antiseptic point of view, every case has been left for ten days without the dressings being disturbed. When taken off on the tenth day I have in each case found the wound dry and soundly healed. In most cases the external portions of the catgut sutures have come away on the dressing, the internal portion having been absorbed. The pads were dry and caked. The same result exactly followed in the case of a woman æt. 33, the subject of an irreducible femoral epiplocele of the right side. In her case the sac and omentum were ligatured en masse close to the crural ring, and were then excised. I sewed together the external and internal walls of the crural canal, stitching them also to the pedicle. No special space or pucker was left for drainage, and when the first dressing was removed the wound was soundly healed. In none of these cases did any sinus remain to cause after trouble, as so often results when a drainage-tube has been used. On the 2d of April, last, I excised the right lobe of the thyroid gland from a lady æt. 34, who had been admitted into a pay ward in the Adelaide Hospital. A great portion of the lobe had been transformed into a large cyst. All the deep parts were carefully sutured together, so as to leave no spaces in the neck. A small pucker was left in the lower end of the skin wound. The wound was dressed with sero-sublimate gauze and turf-moss pads. The wound was perfectly healed on the tenth day, when the dressings were removed for the first and last time. The patient left hospital on the thirteenth day. In operating for cancer in the breast I have been in the habit for the past few years of completely cleaning out the axilla in all cases, as recommended by Kocher, of Berne. This proceeding of course renders necessary a much larger wound than when the breast alone is removed. In applying the principle of deep sutures I begin at the axilla, so as to obliterate the cavity necessarily left by the removal of all the lymphatic glands from the part. Then the fascia and any divided muscles are stitched together, and finally the skin, a gap being left at about the junction of the upper third with the lower two-thirds for drainage; that is, that in this situation about an inch or an inch and a half of the skin wound is not sutured. I have almost uniformly found the healing process completed under a simple dressing, when this was removed on the tenth or fourteenth day; in a few cases a second dressing was required. On the 27th of September last I removed the entire left breast for scirrhus from a lady in Waterford, æt. 71, assisted by my late colleague, Mr. Warren, and by Dr. Martin, of Portland, and Dr. Findlater. The axilla was cleaned out at the same time. Deep sutures were used; no drainage-tube was inserted, and the wound was amply surrounded with the dry dressings. I did not see her again for a fortnight, for as a record of the temperature was sent to me daily, and this remained normal throughout, I was satisfied that the wound would run an aseptic course. On the fifteenth day the dressings were removed for the first time, and the wound was found soundly healed in its whole extent.

In certain cases, however, it is not sufficient merely to leave gaps between the edges of the skin to carry off the discharges, nor even do holes punched in the skin at the most depending parts effect all we can desire. In such cases we must have recourse to other methods for securing ample drainage. Take for example a case of excision of the knee-joint, Here we may expect a large amount of discharge, not only during the first twenty-four hours, but for several days. In such cases I have adopted a method of securing free drainage without the use of drainage tubes, for which we are indebted to Neuber of Kiel. The method consists in this: The incision to expose the joint is the ordinary transverse incision below the patella. The operation having been completed, before bringing the parts together the extremity of the incision at either side is made bifid, so as to enclose between them a narrow tongue of skin. The base of this tongue is below, the apex above. Each of these tongues is then turned inwards, so as almost to touch each other in the middle of the limb, behind the bones. The apices are secured in this position by means of a catgut suture. When the parts have been brought into position and all the suturing finished, we have on each side a channel formed, which runs from the deepest part of the wound to the outside. The dry dressings are then applied, and I prefer to have the splint embraced in them. Such a dressing can be left on for weeks. On the 4th of May last I excised the knee-joint of a boy, æt. 9, at the Surgical Home in Rathmines, in the presence of Mr. J. K. Barton, Mr. Warren, Mr. Swan and Dr. Swaine. The method for drainage described above was employed, the bones were sutured with strong silver wire, deep sutures were inserted and the splint and limb enveloped in dry dressings. These dressings remained undisturbed till the twenty-first day, and when removed the wound was found firmly healed in its whole extent, except for two small granulating spots about the size each of a sixpence, which showed where the skin had been turned in. They were quite superficial and soon healed. I saw the boy last on the 30th of October; he could then walk well on the limb without support of any kind. There was no tenderness on pressure anywhere, even over the course of the two silver sutures in the bones, which have never been re moved.

On the 2d of June last, I excised the hip of a little girl æt. 6 in the Adelaide Hospital. I found the head of the bone necrosed and lying loose in the cavity of the joint, which was filled with pus. About two-thirds of the neck of the femur was excised, and the cancellous tissue in the great trochanter and adjacent part of the shaft thoroughly scraped out. The acetabulum was also scraped clean. The lesser trochanter was also necrosed and lay in a small pond of pus. Deep sutures were also employed in this case, but owing to the large cavity which it was impossible to obliterate, I inserted two drainage tubes and left besides a wedge-shaped opening between them. Besides applying the dry dressings the wound was filled with iodoform. The case was dressed only on the sixth day, when the drainage tubes were taken out, and once again on the eighteenth day. When this dressing was removed, the healing process was found to have been completed. That is, that in this case of excision of the hip, perfect healing was obtained under three dressings. In September last my colleague, Mr. J. H. Scott, obtained a similar result. I have cited these cases, not because they are exceptional in our experience of what can be effected by the method of dry dressing when grafted on to the great principle of antiseptic surgery, but because they illustrate the different methods of carrying out this practice.